higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

PHYSICAL SCIENCE

(First paper)
NQF LEVEL 2

(10021002)

28 November 2024 (Y-paper)
13:00–16:00

Nonprogrammable calculators and drawing instruments may be used.

This question paper consists of 11 pages and 1 data sheet.

555Q1N2428

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)
PHYSICAL SCIENCE
(First paper)
NQF LEVEL 2
TIME: 3 HOURS
MARKS: 150

INSTRUCTIONS AND INFORMATION

1. Answer all the questions.
2. Read all the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Start each section on a new page.
5. Subsections of questions must be kept together.
6. Take gravitational acceleration g = 9.8 m. s^{-2}
7. All calculations should consist of at least the following THREE steps:

   Formula used or manipulation thereof
   Substitution of the data in the formula
   Answer with the correct SI unit

8. All final answers must be rounded off to TWO decimal places.
9. Use only a black or blue pen for written work.
10. Diagrams should be neat, and a pencil may be used.
11. Write neatly and legibly.

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SECTION A

QUESTION 1

Complete the following sentences by writing only the missing word(s) next to the question number (1.1–1.5) in the ANSWER BOOK.

1.1 A … is an instrument used to measure voltage.

1.2 A … is a single disturbance in a medium that passes through a medium.

1.3 … energy is the sum of potential and kinetic energy.

1.4 Unlike charges …

1.5 Conductors of electricity have … resistance.

(5 × 1) **[5]**

QUESTION 2

Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (2.1–2.5) in the ANSWER BOOK.

2.1 Electrostatics consist of electricity flowing free of electrical conductors.

2.2 An inclined plane is classified as a simple machine.

2.3 Longitudinal waves move parallel (back and forth) to the direction of the propagation of the wave.

2.4 Uniform acceleration occurs when the velocity is uniform.

2.5 Mass is equivalent to the weight.

(5 × 2) **[10]**

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QUESTION 3

Choose an term from COLUMN B that matches a description in COLUMN A. Write only the letter (A–G) next to the question number (3.1–3.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
3.1	The energy an object possesses due to motion	A	Scientific method
3.2	A process whereby a light ray bounces back after hitting a surface	B	Displacement
3.3	A force that has equal magnitude as the resultant force but moves in the opposite direction	C	Speed
3.4	Steps on how to conduct the experiment	D	Battery
3.5	A group of cells connected in an electric circuit	E	Reflection
		F	Kinetic energy
		G	Equilibrant

(5 × 1) **[5]**

QUESTION 4

Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (4.1–4.5) in the ANSWER BOOK.

4.1 A block of 2 kg lying on the surface is pulled horizontally with a force of 5 N causing it to move at a constant velocity. The magnitude of the frictional force is equal to …

A 2 N
B 19,2 N
C 5 N
D 10 N

4.2 Wavelength can be measured from …

A crest to trough.
B crest to crest.
C amplitude to amplitude.
D antinode to node.

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4.3 Alternating current …

A moves in one direction.
B moves back and forth.
C measures current.
D measures power.

4.4 In a third-class lever, …

A the load is further away from the pivot than the effort.
B the effort is further away from the pivot than the load.
C the fulcrum is in the middle position.
D the load represents the fulcrum.

4.5 … of current (I) flows when one coulomb of charge (Q) passes at a point in a circuit in one second of time (t).

A One coulomb
B One volt
C One ohm
D One ampere

(5 × 3) **[15]**

TOTAL SECTION A: 35

SECTION B

QUESTION 5: MEASUREMENTS AND SCIENTIFIC INVESTIGATION

Draw diagrams to represent the physical quantities listed below. Use the scales provided.

NOTE: Diagrams DO NOT need an appropriate scale.

5.1 Distance of 100 m run by an athlete. (Scale: 50 m = 1 cm)

5.2 An upward force of 500 N of an amusement ride. (Scale: 100 N = 1 cm)

5.3 The velocity of 200 m/s of a car travelling east. (Scale: 100 m/s = 1 cm)

(3 × 2) **[6]**

QUESTION 6: MOTION

At an amusement park, the driver of bumper car **A** of mass = 100 kg, starts riding his car from rest and accelerates for 60 seconds until he reaches a maximum speed of 5 m/s. He maintains this speed for the next 3 minutes until another bumper car **B**, moving in the same direction, hits him from the back, pushing his car against a blockage. Car **A** is stuck between the blockage and car **B** for 1 minute.

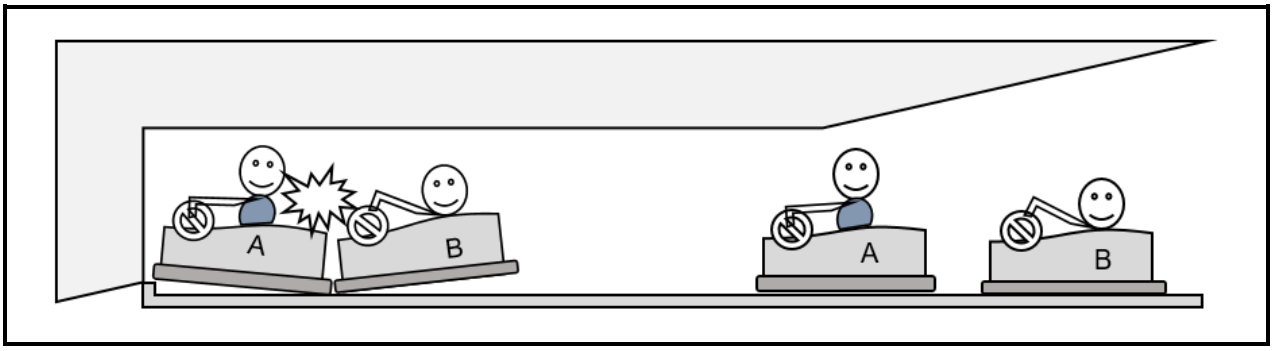


FIGURE 1

6.1 Calculate the acceleration of bumper car **A** during the first 60 seconds. (4)

6.2 Determine the velocity for bumper car A during the 3 minutes of the ride. (2)

6.3 What is the velocity of bumper cars **A** and **B** during the last 1 minute of their ride? (1)

6.4 If a complete lap is 500 metres, how many laps did the driver of bumper car A cover after 5 minutes? Show ALL calculations. (8)

6.5 Calculate the kinetic energy of bumper car **A** at the end of the first 60 minutes. (4)

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6.6 Draw a forces diagram to show all forces acting on the bumper car **A** and car **B** during the last 1 minute of the ride (4)

6.7 Are all force(s) mentioned in QUESTION 6.6 contact or non-contact forces? (2)
[25]

QUESTION 7: SIMPLE MACHINES

FIGURE 2 illustrates a person pushing a wheelbarrow filled with a load of 20 kg. He is pushing with an unknown force. The distance of the load from the fulcrum is 0,5 m and the distance of the effort from the fulcrum is 1,2 m.

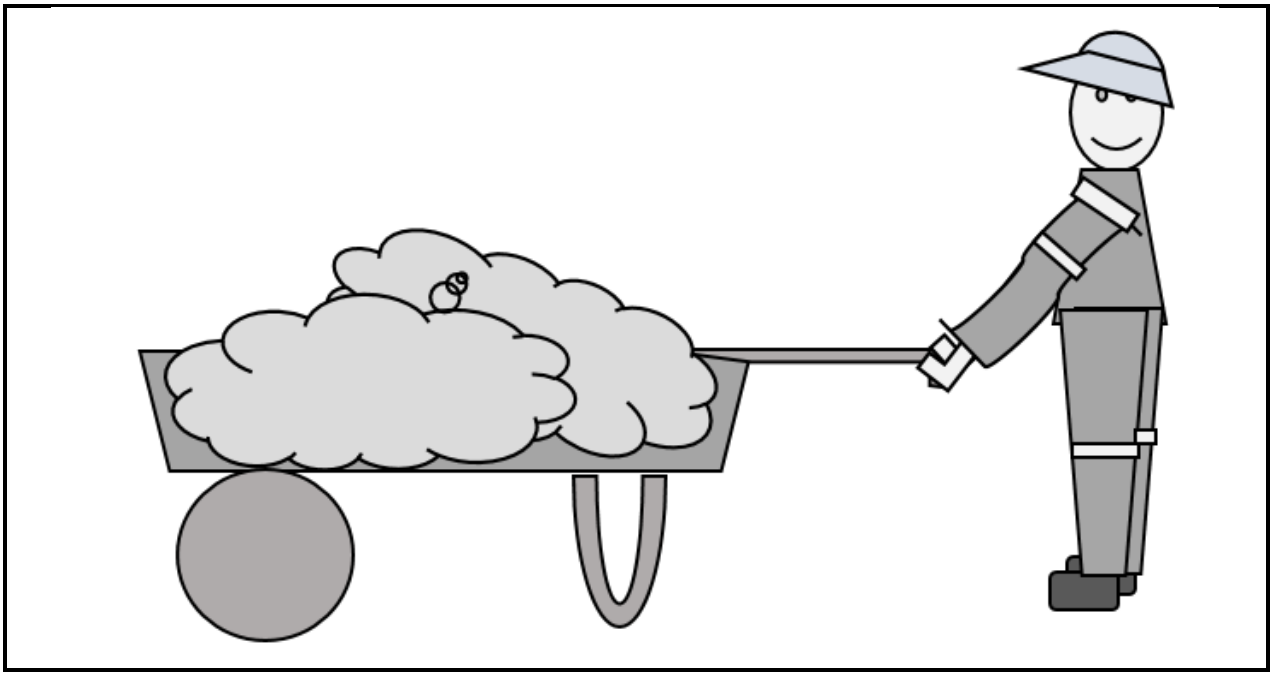


FIGURE 2

7.1 Draw a simplified diagram indicating the load, effort, fulcrum, distance of the load and the distance of the effort. (5)

7.2 What type of class lever is represented in FIGURE 2? (1)

7.3 Calculate the:

7.3.1 load of the lever. (3)

7.3.2 ideal mechanical advantage. (4)

7.3.3 effort of the lever. (3)

7.3.4 efficiency of the system. (3)
[19]

QUESTION 8: WAVES

8.1 A buoy anchored at sea floats up and down on water waves. 10 waves pass in 1 minute. The wavelength of the wave is 0,6 m. The total height at which the buoy rises and drops is 1 m.

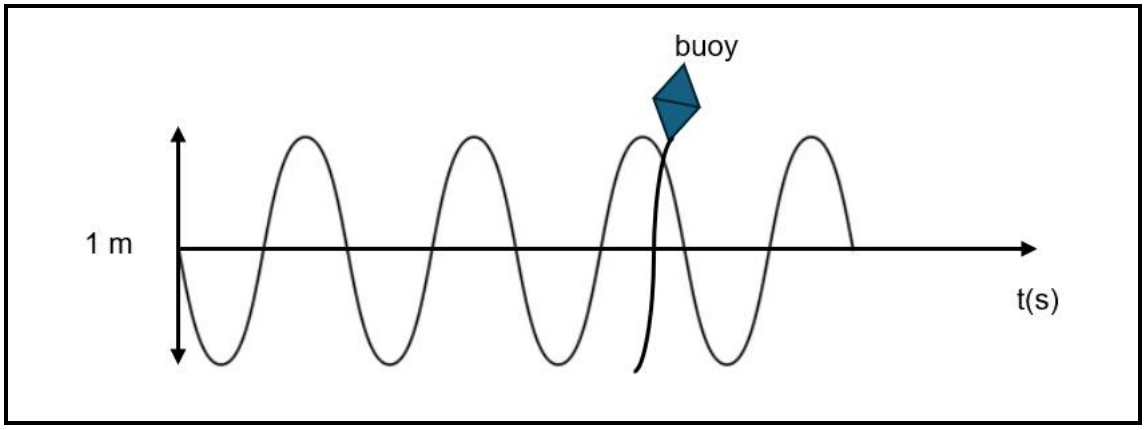


FIGURE 3

8.1.1 What is the type of wave demonstrated by the buoy floating on water waves? (2)

8.1.2 Describe the movement of the wave mentioned in QUESTION 8.1.1 (Choose between: Parallel to the direction of the propagation of the wave/Perpendicular to the direction of the propagation of the wave). (2)

8.1.3 What is the highest point reached on the wave called? (1)

8.1.4 What is the lowest point reached on the wave called? (1)

8.2 Calculate the:

8.2.1 amplitude in metres.

8.2.2 frequency in Hertz.

8.2.3 period in seconds.

(3 × 3) (9)

8.3 The speed of sound waves travelling in air is 330 m/s. Determine the wavelength if a receiving frequency is 20 Hz. (3)

8.4 Describe how destructive interference occurs between two waves. (2)

[20]

QUESTION 9: GEOMETRICAL OPTICS

9.1 A practical task conducted by student A provides an instruction as follows:

A light ray is directed into the transparent rectangular Perspex block. Light enters the Perspex block at an incident angle of 30° directed to the normal line and the angle of refraction is 28°.

9.1.1 Draw a ray diagram showing a light ray entering a rectangular Perspex prism at an angle of 30° from the normal and then passing through it to the other side.

Label all rays and include all angles with their labels and magnitude in the diagram. (7)

9.1.2 What is the name of the phenomenon shown by the path of the ray of light in QUESTION 9.1.1? (1)

9.2 Student A increases the incident angle to 60° and notices that light rays appear on the same side as the path of incidence.

What is the name and magnitude of the angle formed from the rays that appear on the same side as the path of incidence? (2)
[10]

QUESTION 10: MAGNETISM

10.1 A plastic ruler is charged and then brought closer to pieces of paper lying on a surface in FIGURE 4.

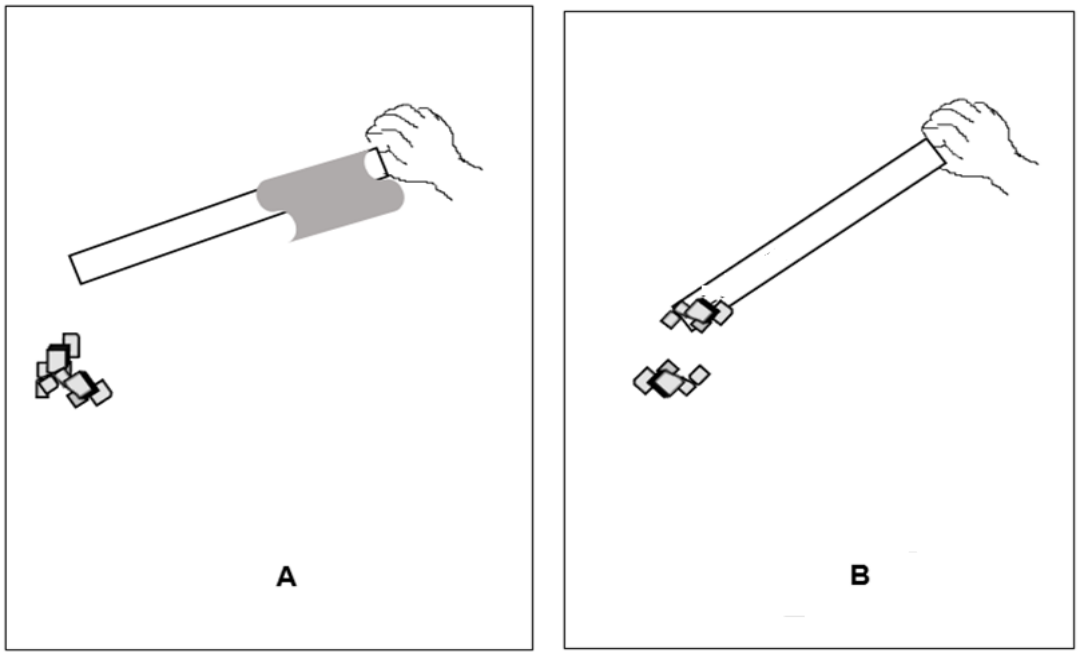


FIGURE 4

10.1.1 Explain how the ruler is charged at A and state the charge obtained. (3)

10.1.2 What charge is obtained by the ruler after rubbing? (1)

10.1.3 What happens when the ruler is brought closer to the pieces of paper? (3)

10.1.4 What type of force exists between the ruler and the papers in QUESTION 10.1.3? (2)

10.2 Explain how the pieces of paper attached to the ruler will drop after a while. (3)

[12]

QUESTION 11: ELECTRICITY

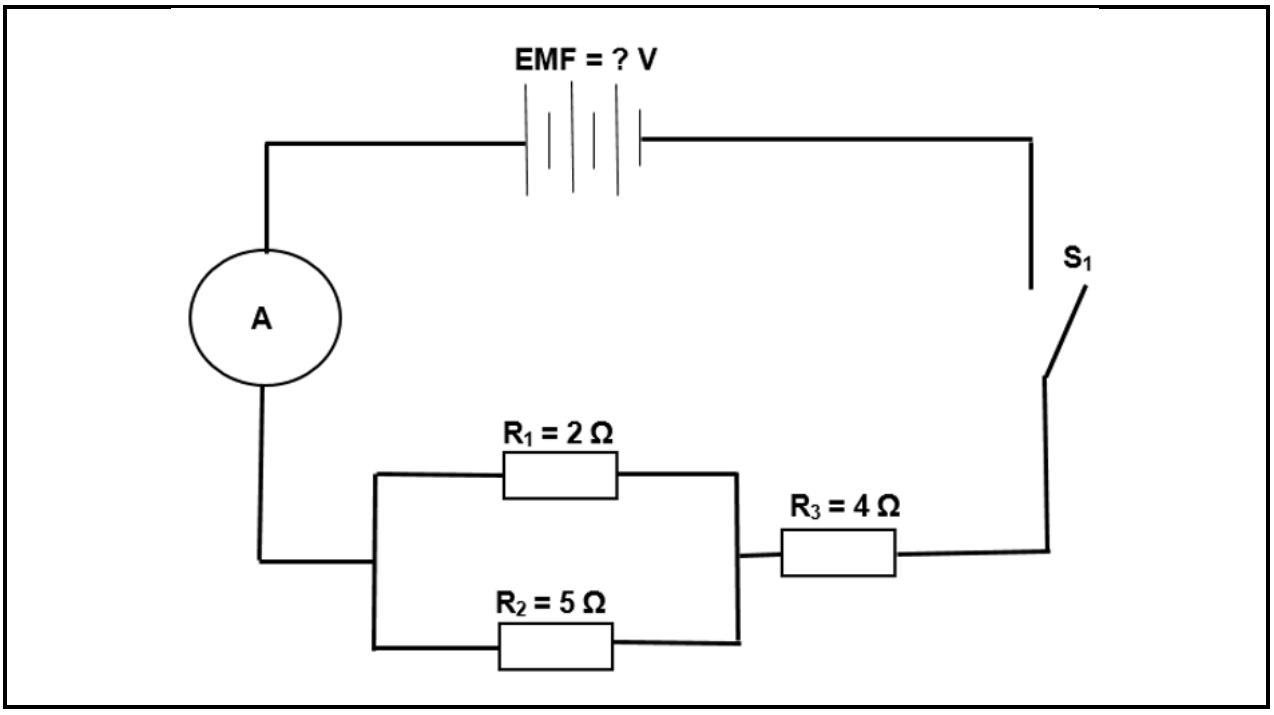


FIGURE 5

11.1 Two resistors R_1 and R_2 are connected in parallel and R_3 is connected in series. The emf of each cell is 1,5 V when the switch S_1 is open. The ammeter is connected in series.

Calculate the:

11.1.1 effective resistance of the resistors connected in parallel. (5)

11.1.2 total resistance in the circuit when the switch is closed. (4)

11.1.3 emf of the supply. (4)

11.2 Determine the value of current flow in a light bulb if 20 coulombs pass through in 50 seconds. (4)

11.3 List FOUR factors that affect resistance. (4)

11.4 Mention TWO sources of direct current (DC). (2)

[23]

TOTAL SECTION B: 115
GRAND TOTAL: 150

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DATA FOR PHYSICAL SCIENCES LEVEL 2 P1

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Acceleration due to gravity	g	9.8 $m.s^{-2}$
Speed of light in vacuum	c	$3,0 \times 10^{8}$ $m.s^{-1}$

TABLE 2: FORMULAE

MECHANICS

$v = u + at$	$E = \frac{1}{2}mv^2$
$v^2 = u^2 + 2as$	$E = mgh$
$s = ut + \frac{1}{2}at^2$	$AMA = \frac{F(L)}{F(E)}$
$s = \frac{1}{2}(v + u)t$	$IMA = \frac{S(E)}{S(L)}$
$F = mg$	$W = F \times S$
	$\eta = \frac{AMA}{IMA} \times 100\%$

WAVES, SOUND AND LIGHT

$v = f\lambda$
$T = \frac{1}{f}$

ELECTRICITY AND MAGNETISM

$R = R_1 + R_2$	$Q = It$
$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$	$E = IR + Ir$
$R = \frac{V}{I}$	$V = \frac{W}{Q}$

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